

NAVAL POSTGRADUATE SCHOOL
Monterey, California

EC 3210

MIDTERM EXAM I

10/96 Prof. Powers

- This exam is open book and notes.
- There are three problems; each is equally weighted.
- Partial credit will be given; be sure to do some work on each problem.
- Be sure to include units in your answers.
- Please circle or underline your answers.
- Do *NOT* do any work on this sheet.
- Show *ALL* work.
- Enter your name in the space provided.

1	
2	
3	
Total	

Name: _____

1. A laser source, operating at $\lambda = 1300$ nm, has a spectral wavelength linewidth of 3 nm. Find the longitudinal coherence length of this laser.



2. A laser, operating at $\lambda = 10.6\mu\text{m}$, produces a Gaussian beam with a waist radius of 1 mm. At the waist location, the amplitude of the beam is unity (i.e., one) and the phase is zero.

Find an expression for $E(r, z, t)$ for the wave at a location 800 m from the waist location.



3. A quarter-wave plate, designed to operate at $10.6\mu\text{m}$, is oriented with its fast axis making a 55° angle with the vertical as shown in the Figure. Linearly polarized light at $10.6\mu\text{m}$, aligned vertically, enters the quarter-wave plate.

- (a) What is the state of polarization at the output of the quarter-wave plate? (Explain your reasoning.)
- (b)
 - i. If it is linearly polarized, what is the angle of the polarization axis measured from the vertical?
 - ii. If it is circularly polarized, is it left circular polarized or right circular polarized?
 - iii. If it is elliptically polarized, what is the angle of the *major* axis (measured from the vertical)? (You do *not* need to specify the "handedness" of the wave.)

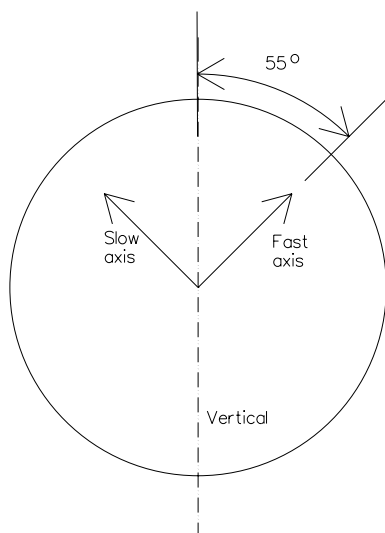


Figure 1: Figure for Prob 3.